

## IN THE CLAIMS

### **Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application.

### **Listing of Claims:**

Claim 1 (currently amended): Method of determining the velocity  $v$  and anellipticity  $\eta$  parameters for processing seismic traces in a common midpoint (CMP) gather including an anelliptic NMO correction, comprising:

- a preliminary step to define a plurality of nodes  $(dtn, \tau_o)$ , the said nodes being indicative of parameters  $dtn$  and  $\tau_o$  representing the NMO correction for the maximum offset and the zero offset travel time in hyperbolic coordinates, the said preliminary step being followed by
  - for each node  $(dtn, \tau_o)$  defined in the preliminary step, the following steps:
    - for static NMO correction of traces in the CMP gather as a function of the values of the said parameters  $dtn, \tau_o$  at the node considered, and
    - for calculating the semblance function associated with the said NMO correction for the node considered; and
  - for each picked time  $t_o$ , a step including determination of the maximum semblance node  $(dtn(t_o), \tau_o(t_o))$ ,

- and a final step to convert the  $dtn(t_o)$  and  $\tau_o(t_o)$  parameters so as to obtain the velocity  $V(t_o)$  and anellepticity  $\eta(t_o)$  laws-

and a step of processing the seismic traces in view of the velocity  $V(t_o)$  and anellepticity  $\eta(t_o)$  laws.

**Claim 2 (original):** Method according to claim 1, wherein the nodes are defined during the preliminary step in an analysis volume ( $dtn$ ,  $\tau_o$ ,  $t_o$ ) determined by minimum and maximum values respectively [ $dtn_{min}$ ,  $dtn_{max}$ ] [ $\tau_{omin}$ ,  $\tau_{omax}$ ] and [ $t_{omin}$ ,  $t_{omax}$ ] of the  $dtn$ ,  $\tau_o$  and  $t_o$  parameters.

**Claim 3 (original):** Method according to claim 2, wherein, during the preliminary step, a corridor [ $dtn_{min}(t_o)$ ,  $dtn_{max}(t_o)$ ], [ $\tau_{omin}(t_o)$ ,  $\tau_{omax}(t_o)$ ] for changing  $dtn$  and  $\tau_o$  parameters is delimited inside the analysis volume as a function of plausible velocity  $V$  and an ellipticity  $\eta$  values, the nodes ( $dtn$ ,  $\tau_o$ ) defined for applying the NMO correction being then located along the corridor thus delimited.

**Claim 4 (previously presented):** Method according to claim 1, further comprising, for each node ( $dtn$ ,  $\tau_o$ ), a stacking step of the corrected seismic traces, following the semblance function calculation step.

**Claim 5 (original):** Method according to claim 4, wherein the stacking of corrected traces is done using only near offset traces.

**Claim 6 (previously presented):** Method according to claim 4, further comprising for each picked time, and following the step for determining the maximum semblance node, a step of checking that values  $dtn$  and  $\tau_o$  of the maximum semblance node correspond to a stacking extreme value for the same values  $dtn$  and  $\tau_o$ .

Claim 7 (previously presented): Method according to claim 1, further comprising a step of selecting and adjusting the pickings obtained, following the step implemented for determining the maximum semblance node ( $dtn(t_0)$ ,  $\tau_0(t_0)$ ) for each picked time  $t_0$ , before the conversion step.

Claim 8 (original): Method according to claim 7, wherein the said step of selecting and adjusting the pickings comprises a step of only retaining pickings  $dtn$  and  $\tau_0$  for which time to the highest semblance pickings is greater than a predefined value.

Claim 9 (original): Method according to claim 8, wherein the said step of selecting and adjusting the pickings also comprises a step for adjusting the retained pickings  $dtn$  and  $\tau_0$  by parabolic interpolations using values about the said picked values.

Claim 10 (original): Method according to claim 9, wherein the said step of selecting and adjusting pickings also comprises a step of eliminating retained and adjusted pickings  $dtn$  and  $\tau_0$  when it is impossible to calculate the Dix interval velocities between the picking considered and higher semblance pickings.

Claim 11 (previously presented): Method according to claim 1, wherein the processing applied to seismic traces is an NMO correction process implementing a static correction  $CORR_{NMO}$ .

Claim 12 (original): Method according to claim 11, wherein, during the preliminary step, the NMO corrections  $CORR_{NMO}$  are calculated for all nodes ( $dtn$ ,  $\tau_0$ ) including in the analysis volume and all offsets of processed seismic traces.

Claim 13 (original): Method according to claim 12, wherein the NMO correction carried out for each node ( $d_{tn}$ ,  $\tau_0$ ), consists of applying NMO corrections  $CORR_{NMO}$  calculated during the preliminary step.

Claim 14 (previously presented): Method according to claim 11, wherein for a given ( $d_{tn}$ ,  $\tau_0$ ) pair, the static NMO correction  $CORR_{NMO}$  of a seismic trace with offset  $x$  is carried out according to the following equation:

$$CORR_{NMO}(x) = -\tau_0 + \sqrt{\tau_0^2 + \frac{d_{tn}(d_{tn} + 2\tau_0)}{x_{max}^2}} \quad x^2 \text{ in which } X_{max} \text{ represents the maximum offset in the}$$

CMP gather.

Claim 15 (withdrawn): Method according to claim 1, wherein the processing applied to seismic traces is a PSTM migration using a static NMO correction  $CORR_{PSTM}$ .

Claim 16 (withdrawn): Method according to claim 15, wherein, during the preliminary step, the NMO corrections  $CORR_{PSTM}$  are calculated for all nodes ( $d_{tn}$  and  $\tau_0$ ) included in the analysis volume and all migration offsets inside the migration aperture.

Claim 17 (withdrawn): Method according to claim 16, wherein the NMO correction step carried out for each node ( $d_{tn}$  and  $\tau_0$ ) comprises, for each offset class, application of the said NMO corrections  $CORR_{PSTM}$ , calculated during the preliminary step on all midpoints inside the migration aperture.

Claim 18 (withdrawn): Method according to claim 17, wherein the NMO correction step carried out for each node ( $dtn$  and  $\tau_0$ ) comprises, for each offset class, the stack of the corrected midpoints following application of the said NMO corrections  $CORR_{PSTM}$ .

Claim 19 (withdrawn): Method according to claim 15, wherein, for a given pair ( $dtn$  and  $\tau_0$ ), the static NMO correction  $CORR_{PSTM}$  is carried out according to the following equation:

$$CORR_{PSTM}(x) = -\tau_0 + \sqrt{\frac{\tau_0^2}{4} + \frac{dtn(dtn + 2\tau_0)(x - x_m)^2}{x_m^2}} + \sqrt{\frac{\tau_0^2}{4} + \frac{dtn(dtn + 2\tau_0)(x - x - h)^2}{x_{max}^2}}$$

where:

-  $x_m$  represents the coordinates of the midpoints,

-  $x - x_m$  represents the migration aperture PSTM,

-  $h$  is the half source – receiver offset,

-  $x_{max}$  is the maximum offset and aperture of the migration.

Claim 20 (previously presented): Method according to claim 14, wherein, during the final conversion step, the parameters  $dtn$  ( $t_0$ ) and  $(\tau_0)$  are converted to the velocity law  $v(t_0)$  according to the following equation:

$$v = \frac{x_{max}}{\sqrt{dtn(dtn + 2\tau_0) \frac{t_0}{\tau_0}}}$$

Claim 21 (previously presented): Method according to claim 14, wherein, during the final conversion step, the parameter  $\tau_0$  ( $t_0$ ) is converted to the anellepticity  $\eta(t_0)$  law according to

$$\eta = \frac{1}{8} \left( \frac{t_0}{\tau_0} - 1 \right)$$

Claim 22 (previously amended): Method according to claim 20, wherein parameter  $dtn$  is defined with respect to the velocity  $v$  and anellepticity  $\eta$  according to the following equation:

$$dtn = \frac{8\eta}{1+8\eta} t_0 + \sqrt{\left(\frac{t_0}{1+8\eta}\right)^2 + \frac{x_{max}^2}{(1+8\eta)V^2}}$$

Claim 23 (original): Method according to claim 21, wherein parameter  $\tau_0$  is defined according to anellepticity  $\eta$  according to the following equation:

$$\tau_0 = \frac{t_0}{1+8\eta}$$

Claim 24 (withdrawn): Method of characterizing a velocity field for processing seismic data using a gather of seismic traces at common midpoint, wherein, for each travel time  $t_0$  for a zero offset, a set of parameters  $dtn$  and  $\tau_0$  is defined, representing the NMO correction for maximum offset, and the zero offset travel time respectively, in hyperbolic coordinates.

Claim 25 (original): Method according to claim 2, further comprising, for each node  $(dtn, \tau_0)$ , a stacking step of the corrected seismic traces, following the semblance function calculation step.

Claim 26 (original): Method according to claim 25, wherein the stacking of corrected traces is done using only near offset traces.

Claim 27 (original): Method according to claim 25, further comprising for each picked time, and following the step for determining the maximum semblance node, a step of checking that values  $dtn$  and  $\tau_0$  of the maximum semblance node correspond to a stacking extreme value for the same values  $dtn$  and  $\tau_0$ .

Claim 28 (original): Method according to claim 2, further comprising a step of selecting and adjusting the pickings obtained, following the step implemented for determining the maximum semblance node ( $dtn(t_o)$ ,  $\tau_o(t_o)$ ) for each picked time  $t_o$ , before the conversion step.

Claim 29 (original): Method according to claim 28, wherein the said step of selecting and adjusting the pickings comprises a step of only retaining pickings  $dtn$  and  $\tau_o$  for which time to the highest semblance pickings is greater than a predefined value.

Claim 30 (original): Method according to claim 29, wherein the said step of selecting and adjusting the pickings also comprises a step for adjusting the retained pickings  $dtn$  and  $\tau_o$  by parabolic interpolations using values about the said picked values.

Claim 31 (original): Method according to claim 30, wherein the said step of selecting and adjusting pickings also comprises a step of eliminating retained and adjusted pickings  $dtn$  and  $\tau_o$  when it is impossible to calculate the Dix interval velocities between the picking considered and higher semblance pickings.

Claim 32 (original): Method according to claim 2, wherein the processing applied to seismic traces is an NMO correction process implementing a static correction  $CORR_{NMO}$ .

Claim 33 (original): Method according to claim 32, wherein, during the preliminary step, the NMO corrections  $CORR_{NMO}$  are calculated for all nodes ( $dtn$ ,  $\tau_o$ ) including in the analysis volume and all offsets of processed seismic traces.

Claim 34 (original): Method according to claim 32, wherein the NMO correction carried out for each node ( $d_{tn}$ ,  $\tau_0$ ), consists of applying NMO corrections  $CORR_{NMO}$  calculated during the preliminary step.

Claim 35 (original): Method according to claim 32, wherein for a given ( $d_{tn}$ ,  $\tau_0$ ) pair, the static NMO correction  $CORR_{NMO}$  of a seismic trace with offset  $x$  is carried out according to the following equation:

$$CORR_{NMO}(x) = -\tau_0 + \sqrt{\tau_0^2 + \frac{d_{tn}(d_{tn} + 2\tau_0)}{x_{max}^2}} \quad x^2 \text{ in which } X_{max} \text{ represents the maximum offset}$$

in the CMP gather.

Claim 36 (withdrawn): Method according to claim 2, wherein the processing applied to seismic traces is a PSTM migration using a static NMO correction  $CORR_{PSTM}$ .

Claim 37 (withdrawn): Method according to claim 36, wherein, during the preliminary step, the NMO corrections  $CORR_{PSTM}$  are calculated for all nodes ( $d_{tn}$  and  $\tau_0$ ) included in the analysis volume and all migration offsets inside the migration aperture.

Claim 38 (withdrawn): Method according to claim 37, wherein the NMO correction step carried out for each node ( $d_{tn}$  and  $\tau_0$ ) comprises, for each offset class, application of the said NMO corrections  $CORR_{PSTM}$ , calculated during the preliminary step on all midpoints inside the migration aperture.

Claim 39 (withdrawn): Method according to claim 38, wherein the NMO correction step carried out for each node ( $dtn$  and  $\tau_0$ ) comprises, for each offset class, the stack of the corrected midpoints following application of the said NMO corrections  $CORR_{PSTM}$ .

Claim 40 (currently amended): Method according to claim 36 2, wherein the processing applied to seismic traces is a PSTM migration using a static NMO correction  $CORR_{PSTM}$ , and wherein, for a given pair ( $dtn$  and  $\tau_0$ ), the static NMO correction  $CORR_{PSTM}$  is carried out according to the following equation:

$$CORR_{PSTM}(x) = -\tau_0 + \sqrt{\frac{\tau_0^2}{4} + \frac{dtn(dtn + 2\tau_0)(x - x_m)^2}{x_m^2}} + \sqrt{\frac{\tau_0^2}{4} + \frac{dtn(dtn + 2\tau_0)(x - x - h)^2}{x_m^2}}$$

where:

- $x_m$  represents the coordinates of the midpoints,
- $x - x_m$  represents the migration aperture PSTM,
- $h$  is the half source – receiver offset,
- $x_{max}$  is the maximum offset and aperture of the migration.

Claim 41 (original): Method according to claim 35, wherein, during the final conversion step, the parameters  $dtn$  ( $t_0$ ) and  $(\tau_0)$  are converted to the velocity law  $v(t_0)$  according to the following equation:

$$v = \frac{x_{max}}{\sqrt{dtn(dtn + 2\tau_0) \frac{t_0}{\tau_0}}}$$

Claim 42 (original): Method according to claim 35, wherein, during the final conversion step, the parameter  $\tau_0$  ( $t_0$ ) is converted to the anellepticity  $\eta(t_0)$  law according to  $\eta = \frac{1}{8} \left( \frac{t_0}{\tau_0} - 1 \right)$

Claim 43 (original): Method according to claim 41, wherein parameter  $dtn$  is defined with respect to the velocity  $v$  and anellepticity  $\eta$  according to the following equation:

$$dtn = \frac{8\eta}{1+8\eta} t_0 + \sqrt{\left(\frac{t_0}{1+8\eta}\right)^2 + \frac{x_{max}^2}{(1+8\eta)V^2}}$$

Claim 44 (original): Method according to claim 42, wherein parameter  $\tau_0$  is defined according to anellepticity  $\eta$  according to the following equation:

$$\tau_0 = \frac{t_0}{1+8\eta}$$

Claim 45 (original): Method according to claim 3, further comprising, for each node ( $dtn$ ,  $\tau_0$ ), a stacking step of the corrected seismic traces, following the semblance function calculation step.

Claim 46 (original): Method according to claim 45, wherein the stacking of corrected traces is done using only near offset traces.

Claim 47 (original): Method according to claim 45, further comprising for each picked time, and following the step for determining the maximum semblance node, a step of checking that values  $dtn$  and  $\tau_0$  of the maximum semblance node correspond to a stacking extreme value for the same values  $dtn$  and  $\tau_0$ .

Claim 48 (original): Method according to claim 3, further comprising a step of selecting and adjusting the pickings obtained, following the step implemented for determining the maximum semblance node ( $dtn(t_0)$ ,  $\tau_0(t_0)$ ) for each picked time  $t_0$ , before the conversion step.

Claim 49 (original): Method according to claim 48, wherein the said step of selecting and adjusting the pickings comprises a step of only retaining pickings  $d_{tn}$  and  $\tau_o$  for which time to the highest semblance pickings is greater than a predefined value.

Claim 50 (original): Method according to claim 49, wherein the said step of selecting and adjusting the pickings also comprises a step for adjusting the retained pickings  $d_{tn}$  and  $\tau_o$  by parabolic interpolations using values about the said picked values.

Claim 51 (original): Method according to claim 50, wherein the said step of selecting and adjusting pickings also comprises a step of eliminating retained and adjusted pickings  $d_{tn}$  and  $\tau_o$  when it is impossible to calculate the Dix interval velocities between the picking considered and higher semblance pickings.